MULTIMEDIA **UNIVERSITY**

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

BFS1024 – STATISTICS FOR FINANCE
(All sections / Groups)

25 OCTOBER 2019
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **9 pages** including statistical formulas and statistical tables with **4 questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. Students are allowed to use non-programmable scientific calculators that are permitted to be used in the examination.

Question 1 (25 Marks)

Sixteen people work as food delivery riders at two food delivery services; Food Panda and GrabFood. They were paid at hourly rates (in RM) as follows:

Food Panda	8.50	12.50	13.00	9.00	10.50	9.00	7.00	7.50
GrabFood	10.50	11.50	9.00	11.00	11.00	11.00	9.50	12.00

a) Compute the average and median of hourly payment for both food delivery services. Compare the average amounts obtained by riders between both groups.   [10 marks]

b) Compute the range and standard deviation of hourly payment for both food delivery services. From the standard deviation values obtained, which services offer more consistent hourly payment? Justify your answer.   [10 marks]

c) How do you describe the shape of distribution of the hourly payment for both companies? Proof it statistically.   [5 marks]

Question 2 (25 Marks)

a) A study has been conducted which showed the number of parents who have provided financial assistance to support living expenses and to pay rent for their adult children. A sample of 150 parents participated in this study. 38 of them helped their adult children to support living expenses and also pay rent. There are 58 parents have not support living expenses of their adult children but 25 of them are found to assist their adult children to pay rent.

   i. Construct a contingency table to describe the outcome for the above study.

   [6 marks]

   ii. What is the probability that parents did not help their adult children for both situation; support living expenses and pay rent?   [2 marks]

   iii. If parents did not support living expenses of their adult children, what is the probability that the parents will not help to pay rent too.   [3 marks]

b) From a magazine article, it reported that fifteen percent of undergraduate students carry credit card balances greater than $5000. Suppose 10 undergraduate students are selected randomly to be interviewed about credit card usage, find the probability that less than three of them will have a credit card balance greater than $5000.   ·

   [5 marks]

Continued...

c) Delisha operates a pastry shop selling variety of cakes and breads. Let X denotes the number of Carrot cakes sold daily. The distribution of sales for Carrot cakes are as follows:

X	15	18	20	25	33
P(X)	0.12	0.25	0.35	0.20	0.08

i. Find the average and standard deviation of Carrot cakes sold daily? [6 marks]

ii. The selling price of a Carrot cake is RM65. Compute the average daily revenue gained by Delisha from sales of Carrot cakes. [3 marks]

Question 3 (25 Marks)

a) A bank would like to study the waiting time of serving customers during the noon-to-1p.m. lunch period of their branches located at two places; in a commercial district of a city and in a residential area. Data are collected from a random sample of 20 customers, and the waiting time (in minutes) are recorded from both branches as follows:

Commercial District					Residential Area				
4.21	5.55	3.02	5.13	4.77	9.66	5.90	8.02	5.79	8.73
2.34	3.54	3.20	4.50	6.10	3.82	8.01	8.35	6.68	5.64

At 5 percent significance level, can we conclude that the customers at branch which located in residential area need to wait longer compared to the customers who entered bank branch in the commercial district? [15 marks]

b) A researcher interested to study on the average rate of income tax paid among senior executives in private sector. A random sample of 15 senior executives of several firms is taken. The amount each executive paid for income taxes as a percentage of gross income is determined. The data are

16.0	28.0	18.6	20.2	30.4	22.4	22.4	33.7
23.2	24.1	24.3	24.7	25.2	25.9	26.3	

Construct a 90% confidence interval for the average rate of income tax paid among senior executives in private sector. [10 marks]

Continued....

Question 4 (25 Marks)

A marketing manager of a bank claimed that the demographic profile of customers may give clear picture for the bank to understand the need of the customer including estimating their average bank balance. In selling a right product to right customer, the manager suggested to study the demographic information on customers in the bank's current market which significantly related to their bank balances.

Using banking data, he analysed three demographic profiles of 50 customers; customers' age (in years), monthly income (in RM'000) and home values (in RM'0000) to predict their average bank balances (in RM'00). The summary output of the analysis is shown below:

ANOVA

	df	SS	MS	F	Significance F
Regression	3	4341107925	1447035975	342.44	$3.065*10^{-4}$
Residual	46	194380797	4225669.499		
Total	49	7640844145			

	Coefficients	Std Error	t Stat	P-value
Intercept	10710.64	4260.98	2.51366	
Age	1.46	0.40691	3.58803	0.00053
Income	8.665	1.65831	5.22521	$1.011*10^{-6}$
Home value	-0.00918	0.0110	-0.831945	0.40750

a) State the multiple linear regression equation for the above data.   [4 marks]

b) Interpret the slope coefficient for the customer's age and customer's monthly income relating to the bank balances.   [4 marks]

c) Compute the adjusted R^2 and interpret its meaning.   [5 marks]

d) At the 1 percent level of significance, test if each independent variable is significantly related towards bank balances. Use the p-value approach.   [9 marks]

e) What would the customer's bank balance be if he or she is 36 years old, has monthly income around RM4,500 and owns a house with value RM 275,000?   [3 marks]

End of Page

A.   DESCRIPTIVE STATISTICS

$$\text{Mean} = \frac{\sum X_i}{n}$$

$$\text{Standard Deviation (s)} = \sqrt{\frac{\sum X^2}{n-1} - \frac{(\sum X)^2}{n(n-1)}}$$

$$\text{Pearson's Coefficient of Skewness } (S_k) = \frac{3(\overline{X} - \text{Median})}{s} \text{ or } \frac{\overline{X} - \text{Mode}}{s}$$

B.   PROBABILITY

P (A or B) = P (A) + P (B) - P (A and B)

P (A and B) = P (A) P (B) if A and B are independent

P (A | B) = P (A and B) / P (B)

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = n p and variance = VAR(X) = npq   where q = 1 - p

Normal Distribution

If X follows a Normal distribution N(μ, σ) where E(X) = μ and VAR(X) = σ^2

then $z = \dfrac{X - \mu}{\sigma}$

C.   EXPECTATION AND VARIANCE OPERATORS

E (X) = $\sum[X \bullet P(X)]$

VAR (X) = E(X²) - [E(X)]²

If E (X) = μ then E (kX) = $k\,\mu$, E(X + Y) = E(X) + E(Y)

If VAR (X) = σ^2 then VAR (kX) = $k^2 \sigma^2$,

VAR (aX + bY) = a²VAR(X) + b²VAR(Y) + 2ab COV(X, Y)

where COV(X, Y) = E(X Y) – [E(X) E(Y)]

D.   CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

(100 - α) % Confidence Interval for Population Mean (σ Known) $= \overline{X} \pm Z_{\alpha/2}\left(\dfrac{\sigma}{\sqrt{n}}\right)$

(100 - α)% Confidence Interval for Population Mean (σ Unknown) $= \overline{X} \pm t_{\alpha/2,n-1}\left(\dfrac{s}{\sqrt{n}}\right)$

(100 - α)% Confidence Interval for Population Proportion $= p \pm Z_{\alpha/2}\sqrt{\dfrac{p(1-p)}{n}}$

Sample Size Determination for Population Mean $= n \geq \dfrac{(Z_{\alpha/2})^2 \sigma^2}{E^2}$

Sample Size Determination for Population Proportion $= n \geq \dfrac{(Z_{\alpha/2})^2 p(1-p)}{E^2}$

Where E = Limit of Error in Estimation

E.   HYPOTHESIS TESTING

One Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$Z = \dfrac{\overline{x} - \mu}{\sigma / \sqrt{n}}$	$t = \dfrac{\overline{x} - \mu}{s / \sqrt{n}}$
One Sample Proportion Test	
$Z = \dfrac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$	

Two Sample Mean Test

Standard Deviation (σ) Known

$$z = \frac{(\overline{x_1} - \overline{x_2})}{\sqrt{\sigma_1^2 / n_1 + \sigma_2^2 / n_2}}$$

Standard Deviation (σ) Not Known

$$t = \frac{(\overline{x_1} - \overline{x_2})}{\sqrt{S_p^2 \left(1/n_1 + 1/n_2 \right)}} \quad \text{where} \quad S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 - 1) + (n_2 - 1)}$$

Two Sample Proportion Test

$$z = \frac{(p_1 - p_2)}{\sqrt{p(1 - p)\left[\dfrac{1}{n_1} + \dfrac{1}{n_2} \right]}} \quad \text{where} \quad p = \frac{(n_1 p_1) + (n_2 p_2)}{n_1 + n_2} = \frac{X_1 + X_2}{n_1 + n_2}$$

where X_1 and X_2 are the number of successes from each population

F.   REGRESSION ANALYSIS

SIMPLE LINEAR REGRESSION:

Correlation Coefficient

$$r = \frac{\sum XY - \left[\dfrac{\sum X \sum Y}{n} \right]}{\sqrt{\left[\sum X^2 - \left((\sum X)^2 / n \right) \right]\left[\sum Y^2 - \left((\sum Y)^2 / n \right) \right]}} = \frac{COV(X, Y)}{\sigma_X \sigma_Y}$$

Regression Coefficient

$$b_1 = \frac{\sum XY - \left[\dfrac{\sum X \sum Y}{n} \right]}{\left[\sum X^2 - \left((\sum X)^2 / n \right) \right]} \quad , \qquad b_0 = \overline{Y} - b_1 \overline{X}$$

MULTIPLE LINEAR REGRESSION:

$$\text{Adjusted r-square} = 1 - \left[\frac{(1-r^2)(n-1)}{(n-p-1)} \right] \text{ where } p = \text{number of independent variables}$$

ANOVA Table for Multiple Linear Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Regression	p	SSR	MSR = SSR/p
Error	$n - p - 1$	SSE	MSE = SSE/$(n - p - 1)$
Total	$n - 1$	SST	

Test Statistic for Significance of the Overall Regression Model = F = MSR/MSE

Test Statistic for Significance of each Explanatory Variable = t* = b_i / S_{bi} and the

Critical t = t $_{(n-p-1), \alpha/2}$

TABLE A.1

Cumulative Standardized Normal Distribution
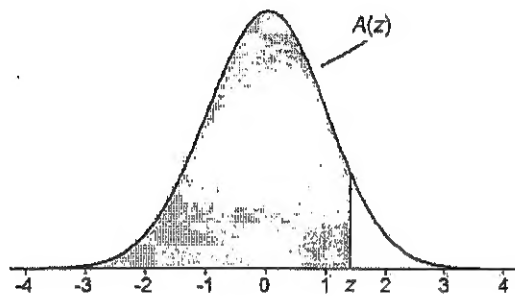
$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

| z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

TABLE 10. PERCENTAGE POINTS OF THE t-DISTRIBUTION

This table gives percentage points $t_\nu(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{\nu\pi}} \frac{\Gamma(\tfrac{1}{2}\nu+\tfrac{1}{2})}{\Gamma(\tfrac{1}{2}\nu)} \int_{t_\nu(P)}^{\infty} \frac{dt}{(1+t^2/\nu)^{\frac{1}{2}(\nu+1)}}.$$

Let X_1 and X_2 be independent random variables having a normal distribution with zero mean and unit variance and a χ^2-distribution with ν degrees of freedom respectively; then $t = X_1/\sqrt{X_2/\nu}$ has Student's t-distribution with ν degrees of freedom, and the probability that $t \geqslant t_\nu(P)$ is $P/100$. The lower percentage points are given by symmetry as $-t_\nu(P)$, and the probability that $|t| \geqslant t_\nu(P)$ is $2P/100$.
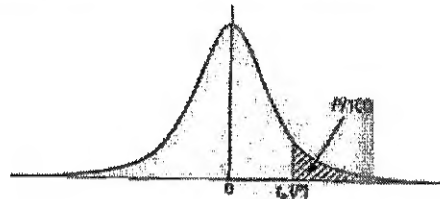
The limiting distribution of t as ν tends to infinity is the normal distribution with zero mean and unit variance. When ν is large interpolation in ν should be harmonic.

P	40	30	25	20	15	10	5	2·5	1	0·5	0·1	0·05
ν = 1	0·3249	0·7265	1·0000	1·3764	1·963	3·078	6·314	12·71	31·82	63·66	318·3	636·6
2	0·2887	0·6172	0·8165	1·0607	1·386	1·886	2·920	4·303	6·965	9·925	22·33	31·60
3	0·2767	0·5844	0·7649	0·9785	1·250	1·638	2·353	3·182	4·541	5·841	10·21	12·92
4	0·2707	0·5686	0·7407	0·9410	1·190	1·533	2·132	2·776	3·747	4·604	7·173	8·610
5	0·2672	0·5594	0·7267	0·9195	1·156	1·476	2·015	2·571	3·365	4·032	5·893	6·869
6	0·2648	0·5534	0·7176	0·9057	1·134	1·440	1·943	2·447	3·143	3·707	5·208	5·959
7	0·2632	0·5491	0·7111	0·8960	1·119	1·415	1·895	2·365	2·998	3·499	4·785	5·408
8	0·2619	0·5459	0·7064	0·8889	1·108	1·397	1·860	2·306	2·896	3·355	4·501	5·041
9	0·2610	0·5435	0·7027	0·8834	1·100	1·383	1·833	2·262	2·821	3·250	4·297	4·781
10	0·2602	0·5415	0·6998	0·8791	1·093	1·372	1·812	2·228	2·764	3·169	4·144	4·587
11	0·2596	0·5399	0·6974	0·8755	1·088	1·363	1·796	2·201	2·718	3·106	4·025	4·437
12	0·2590	0·5386	0·6955	0·8726	1·083	1·356	1·782	2·179	2·681	3·055	3·930	4·318
13	0·2586	0·5375	0·6938	0·8702	1·079	1·350	1·771	2·160	2·650	3·012	3·852	4·221
14	0·2582	0·5366	0·6924	0·8681	1·076	1·345	1·761	2·145	2·624	2·977	3·787	4·140
15	0·2579	0·5357	0·6912	0·8662	1·074	1·341	1·753	2·131	2·602	2·947	3·733	4·073
16	0·2576	0·5350	0·6901	0·8647	1·071	1·337	1·746	2·120	2·583	2·921	3·686	4·015
17	0·2573	0·5344	0·6892	0·8633	1·069	1·333	1·740	2·110	2·567	2·898	3·646	3·965
18	0·2571	0·5338	0·6884	0·8620	1·067	1·330	1·734	2·101	2·552	2·878	3·610	3·922
19	0·2569	0·5333	0·6876	0·8610	1·066	1·328	1·729	2·093	2·539	2·861	3·579	3·883
20	0·2567	0·5329	0·6870	0·8600	1·064	1·325	1·725	2·086	2·528	2·845	3·552	3·850
21	0·2566	0·5325	0·6864	0·8591	1·063	1·323	1·721	2·080	2·518	2·831	3·527	3·819
22	0·2564	0·5321	0·6858	0·8583	1·061	1·321	1·717	2·074	2·508	2·819	3·505	3·792
23	0·2563	0·5317	0·6853	0·8575	1·060	1·319	1·714	2·069	2·500	2·807	3·485	3·768
24	0·2562	0·5314	0·6848	0·8569	1·059	1·318	1·711	2·064	2·492	2·797	3·467	3·745
25	0·2561	0·5312	0·6844	0·8562	1·058	1·316	1·708	2·060	2·485	2·787	3·450	3·725
26	0·2560	0·5309	0·6840	0·8557	1·058	1·315	1·706	2·056	2·479	2·779	3·435	3·707
27	0·2559	0·5306	0·6837	0·8551	1·057	1·314	1·703	2·052	2·473	2·771	3·421	3·690
28	0·2558	0·5304	0·6834	0·8546	1·056	1·313	1·701	2·048	2·467	2·763	3·408	3·674
29	0·2557	0·5302	0·6830	0·8542	1·055	1·311	1·699	2·045	2·462	2·756	3·396	3·659
30	0·2556	0·5300	0·6828	0·8538	1·055	1·310	1·697	2·042	2·457	2·750	3·385	3·646
32	0·2555	0·5297	0·6822	0·8530	1·054	1·309	1·694	2·037	2·449	2·738	3·365	3·622
34	0·2553	0·5294	0·6818	0·8523	1·052	1·307	1·691	2·032	2·441	2·728	3·348	3·601
36	0·2552	0·5291	0·6814	0·8517	1·052	1·306	1·688	2·028	2·434	2·719	3·333	3·582
38	0·2551	0·5288	0·6810	0·8512	1·051	1·304	1·686	2·024	2·429	2·712	3·319	3·566
40	0·2550	0·5286	0·6807	0·8507	1·050	1·303	1·684	2·021	2·423	2·704	3·307	3·551
50	0·2547	0·5278	0·6794	0·8489	1·047	1·299	1·676	2·009	2·403	2·678	3·261	3·496
60	0·2545	0·5272	0·6786	0·8477	1·045	1·296	1·671	2·000	2·390	2·660	3·232	3·460
120	0·2539	0·5258	0·6765	0·8446	1·041	1·289	1·658	1·980	2·358	2·617	3·160	3·373
∞	0·2533	0·5244	0·6745	0·8416	1·036	1·282	1·645	1·960	2·326	2·576	3·090	3·291

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